2nd EUSAAR Absorption Photometer Workshop

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Motivation

The calibration of particle absorption photometers, which functional principle is based on sampling air borne particles on/into fiber filters and measuring the transmittance of radiation (Aethalometer, MAAP, PSAP), is still a challenging tasks. Difficulties are: a) there is no existing calibration standard for absorbing particles, b) a response to scattering particles, which misleadingly can be interpreted as particle absorption and c) the response of photometers to both, absorption and scattering, depends on the total amount of particulate matter collected in the filter. The first EUSAAR Absorption photometer workshop, held 2007 in Leipzig, showed some of these complications.

A second EUSAAR Absorption photometer workshop took place from 22 June to 10 July 2009 in Leipzig. The specific goals were:

1. Measuring loading dependent response of absorption photometers to
    a. Absorbing particles: Carbon black, kerosene soot
    b. Scattering particles: Ammonium sulfate
    c. Ambient air
2. Test of existing correction schemes for Aethalometer, PSAP, and MAAP
3. Developing new correction methods for Aethalometer, PSAP, MAAP

Time schedule

22 – 26 June:

- The instruments for the workshop are expected to arrive on June 22.
- Technical checks of instruments (leak test, etc…)
- Installing instruments, aerosol generators, and data acquisition.

29 June:

- Kick-off meeting for all workshop participants

29 June - 9 July:

- Performing experiments
- Preliminary data evaluation and discussion of experiments

10 July:

- Packing some instruments, which were not used for further experiments

12 -29 July:

- more experiements

12 -29 July:

- Workshop end and packing experiments

Experimental setup

Calibration experiments necessarily require instruments which are “reference” instruments for particle absorption and scattering. Reference instruments for absorption were three Photo-acoustic absorption spectrometer. These instruments do not accumulate particles on an filter and therefore do not shown any loading effect. An integrating nephelometer was reference instrument for particle scattering. The physical aerosol characterization was complemented by measurement of the particle number size distribution (SMPS, APS, etc.).

All photometers and reference instruments were connected to one high volume aerosol tank. The aerosol tank was as a buffer volume to diminish potential spikes in the particle number concentration of the aerosol generators, and to uniformly distribute the aerosol particles to different output ports. All aerosol sources and instruments were connected to the aerosol tank, which facilitates to switch between different aerosols and mixtures of aerosols. During night time measurements with ambient air. Were done

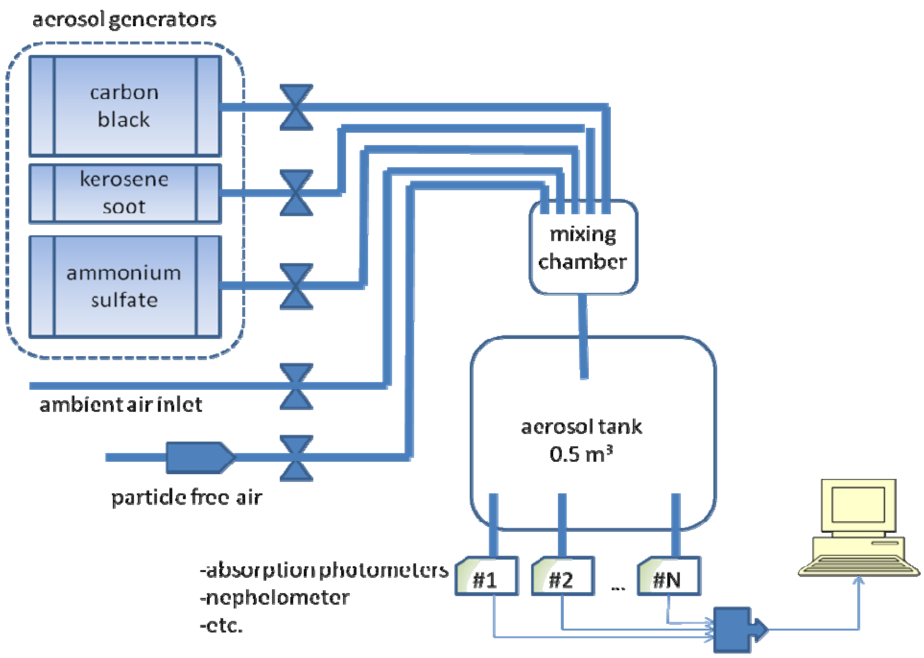

Figure 1: Experimental setup with aerosol generators and instruments.

Data evaluation

Since the data evaluation is not finished only some preliminary results are available. As a first result is was found the the Photacoustic photometers agree within 7% (cf. Fig. 2). The MAAP was on average 7% lower than one of Photoacoustic photometers (cf. Fig 3). An intercomparioson of three PSAPs showed differences of 8% between the instruments (cf Fig. 4). An intercomapriosn of eight Aethalometers showed that one instruments was not working stable. Five instruments agrred well within 5% and tow instruments were higher by about 15%. Further data evaluation will last until June 2010.

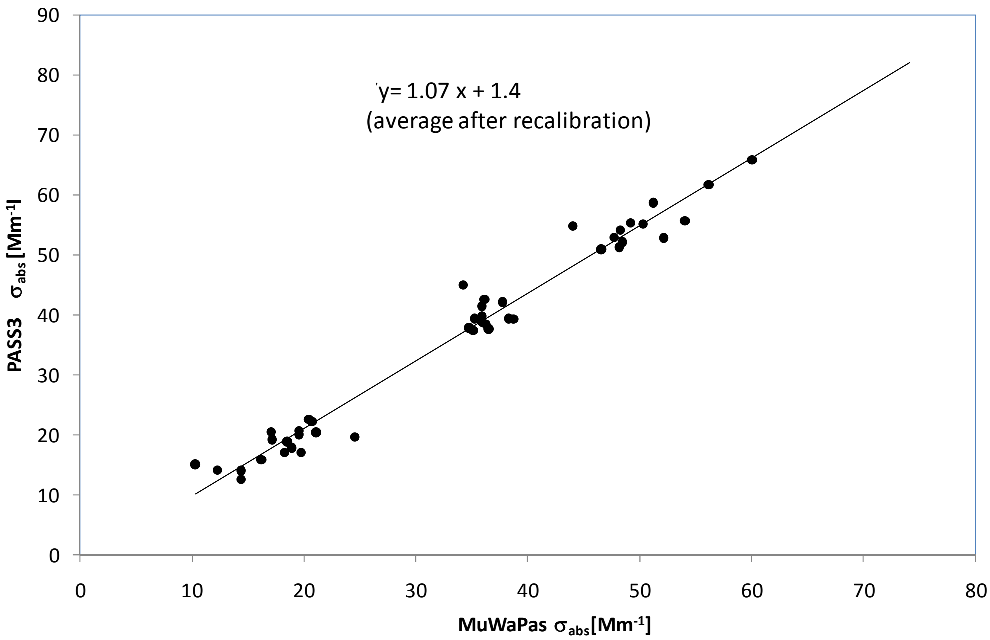

Figure 2: Correlation plot between two Photoacoustic photometers. Data are shown for an optical wavelength of 532 nm.

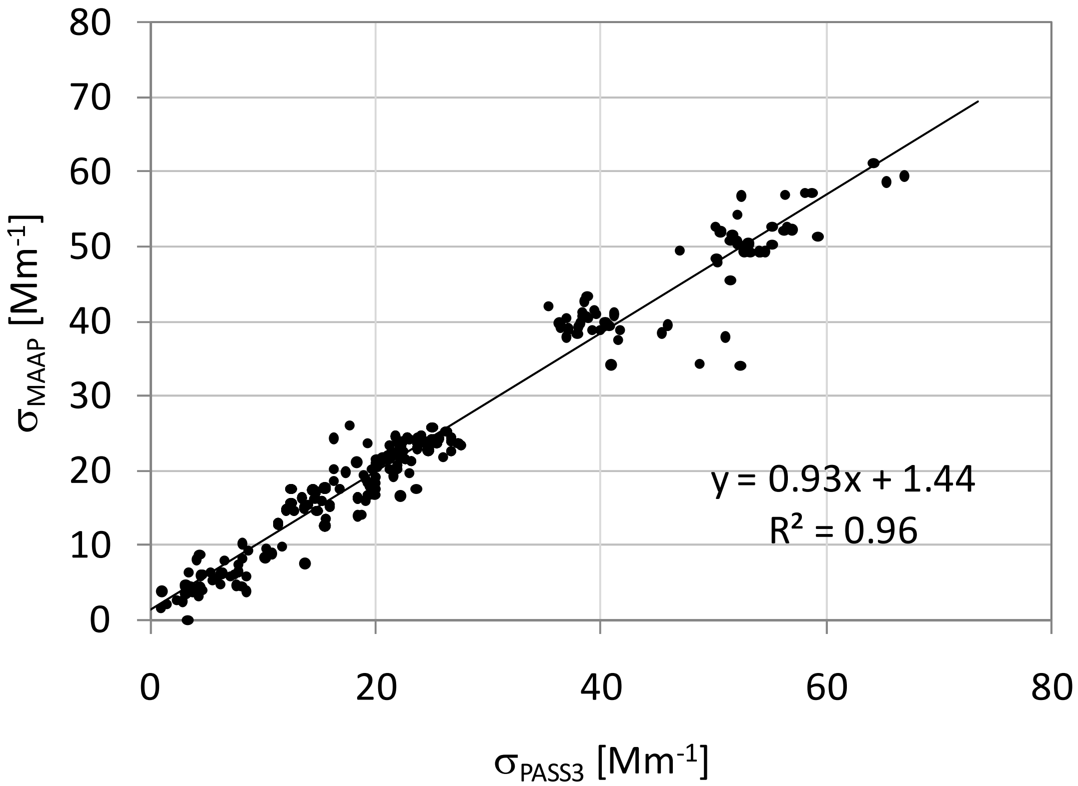

Figure 3: Correlation plot of MAAP and Photoacoustic photometers. Data are shown for an optical wavelength of 532 nm.

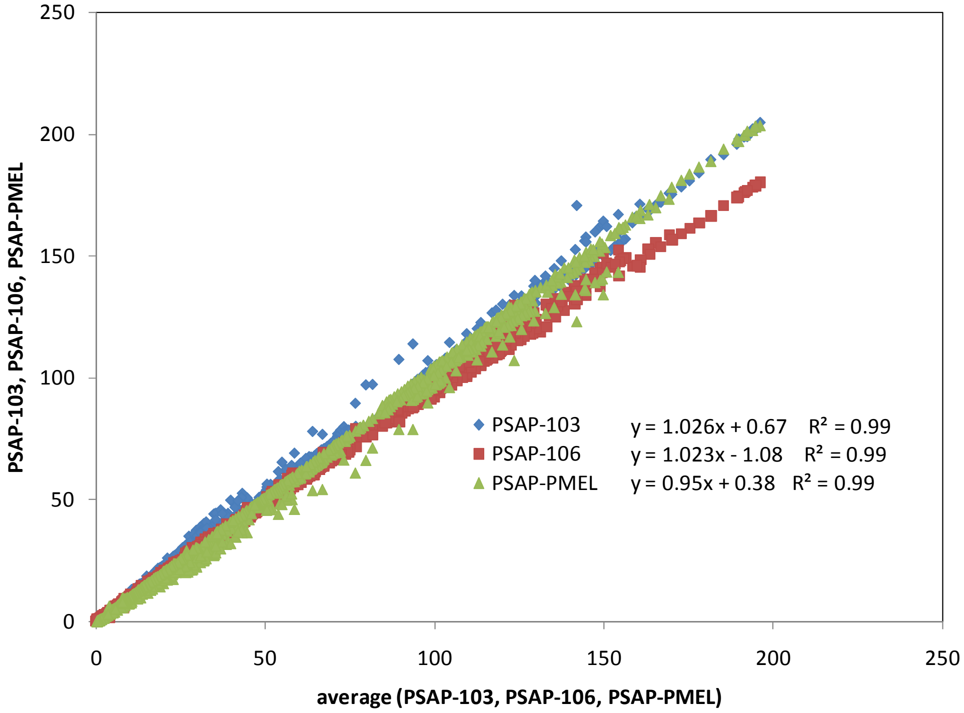

Figure 4: Intercomparion of three PSAPs.

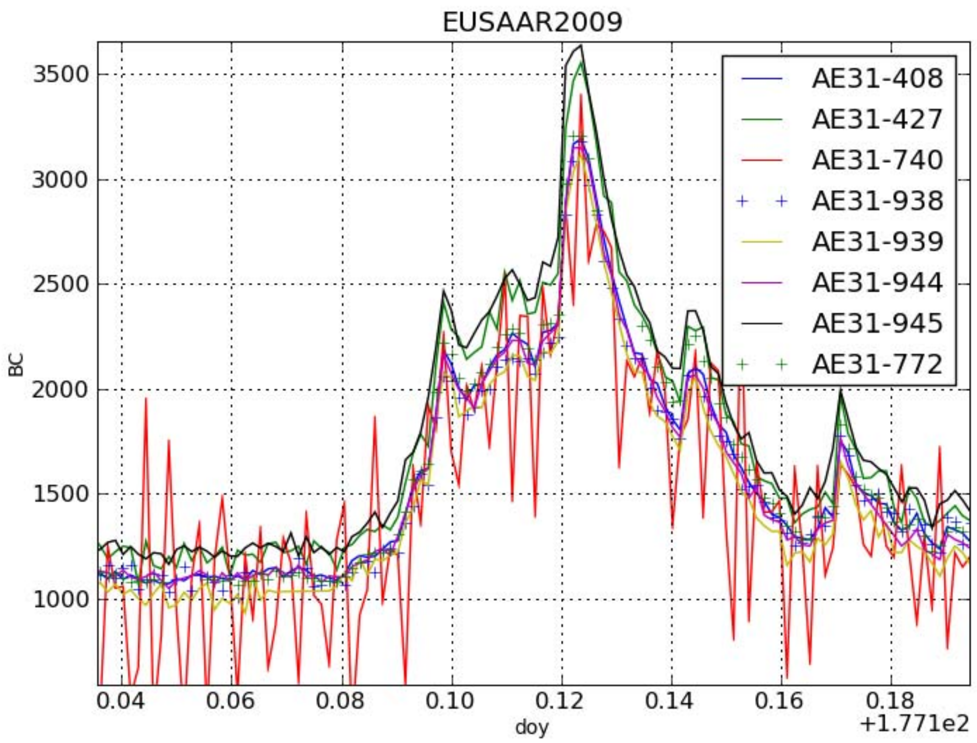

Figure 5: Intercomparion of eight Aethalometers.

Appendix

List of participants of the EUSAAR Absorption Photometer workshop in June/July 2009

Thomas Müller	Inst. for Tropospheric Research	Leipzig	Germany
Carl Meusinger	Inst. for Tropospheric Research	Leipzig	Germany
Thomas Tuch	Inst. for Tropospheric Research	Leipzig	Germany
Alfred Wiedensohler	Inst. for Tropospheric Research	Leipzig	Germany
Bas Henzing	TNO – Netherlands organisation for applied sciences	Utrecht	The Netherlands
Gerrit deLeeuw	TNO – Netherlands organisation for applied sciences	Utrecht	The Netherlands
John Walker	Droplet Measurement Technologies	Boulder	USA
Patrick Sheridan	National Oceanic and Atmospheric Administration	Boulder	USA
Aki Virkkula	University of Helsinki	Helsinki	Finnland
Antti Hyvärinen	Finish Meteorological Institute	Helsinki	Finnland
Kostas Eleftheriadis	Inst. of Nuc. Tech. & Rad. Prot	Athens	Greece
Linda Ronda	Inst. of Nuc. Tech. & Rad. Prot	Athens	Greece
Grisa Mosnic	Aerosol d.o.o.	Ljubljana	Slowenia
Zoltan Bozoki	University of Szeged	Szeged	Hungary
Agnes Filep	University of Szeged	Szeged	Hungary
Paulo Fialho	Universidade dos Açores	Terra-Chã	Portugal
Diana Bankö	University of Pannonia	Vesprem	Hungary
Allessandro Dell'Acqua	EC - Joint Research Centre	Ispra	Italy